DigiVox CORPORATION

ORIGINAL

February 11, 1997

BY HAND DELIVERY

William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, DC 20057

Re: GN Docket No. 96-228

Dear Mr. Caton:

Enclosed as Attachment 1 is a response by Ronald M. Harstad, Ph.D., economist, to the January 24, 1997 memorandum filed by Matthew Moses of the Auctions Division to report ex parte discussions held on January 23, 1997. In particular, Dr. Harstad explains that a highly efficient usage for WCS is to provide facilities based local loop competition. Therefore, low power, low tier wireless mobile service at 2.3 GHz would serve a market niche that is different from the market served by cellular and high tier PCS providers.

Enclosed as Attachment 2 is an additional analysis by Dr. Harstad in which he explains that the adoption of out of band emission standards that would result in preventing the WCS spectrum from being used for low power, low tier wireless mobile services providing local loop competition would be an inefficient use of spectrum, in violation of Section 309(j) of the Communications Act. In view of the submission of the Consumer Electronics Manufacturers Association (discussed below), Dr. Harstad is particularly troubled by efforts to prevent alleged theoretical interference to SDARS, when it is questionable whether SDARS can even work at 2.3 GHz, not to mention the fact that, even if SDARS could work at 2.3 GHz, as discussed below, the standards proposed by Primosphere are much more restrictive than needed to protect SDARS. Indeed the standards proposed by Primosphere are much more restrictive than the standards proposed by other SDARS applicants, such as CD Radio.

On January 28, 1997, the Cellular Telecommunications Industry Association ("CTIA") filed an ex parte memorandum suggesting that wireless mobile services at 2.3 GHz are not feasible, in part because no manufacturers have committed to making equipment for the 2.3 GHz band. In view of the fact that Hughes Network Systems ("Hughes") and Bellcore have said that they can manufacture equipment for a low power, low tier microcellular system, such as PACS, at 2.3 GHz (see comments and reply comments of DigiVox Corporation ("DigiVox") as well as the January 28 and February 5, 1997 ex parte comments of DigiVox), it is clear that CTIA has no credibility on this issue.

0414

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Enclosed as Attachment 3 is the February 5, 1997 letter of Hughes responding to the January 30, 1997 ex parte filing of Primosphere. Hughes demonstrates that Primosphere is taking an extreme position in seeking protection from PACS, even though the noise level from other sources of interference would be higher than the noise level from PACS operating at a minimum separation of 5 MHz from SDARS. Moreover, Hughes explains that Primosphere has not even disclosed its link budget and other key technical parameters of Primosphere's technology. These items must be revealed if the Commission and interested parties are to make an accurate technical interference assessment. Anything short of this will be an abrogation of the Commission's responsibilities under the Communications Act of 1934, as amended, and the Administrative Procedures Act.

Enclosed as Attachment 4 is a copy of an ex parte filing made by the Consumer Electronics Manufacturers Association in IB Docket No. 95-91, GN docket No. 90-357. (Only the summary rather than the entire filing is included with the copies sent to the cc list.) This filing demonstrates that SDARS would not provide an acceptable quality of service in the S-Band and suggests that lower frequencies would be more appropriate for SDARS. Given this problem, it makes little sense for the Commission to adopt out of band emission standards such as those suggested by Primosphere, because such standards would be protecting a service that is not likely to provide acceptable service anyway. Instead, DigiVox proposes that the Commission adopt out of band emission limits as proposed by the Commission in its Notice of Proposed Rulemaking or as proposed by Hughes Network Systems ("Hughes") in DigiVox's ex parte filings of January 28 and February 5, 1997. The out of band emission limits as proposed by Hughes would not increase the noise levels to SDARS above those levels already caused by other sources.

Very truly yours,

John Prawat
President and CEO

cc: Michele Farquhar, Chief, Wireless Telecommunications Bureau
D'Wana Speight, Wireless Telecommunications Bureau
Thomas P. Stanley, Wireless Telecommunications Bureau
Nancy Markowitz, Wireless Telecommunications Bureau
Kathleen O'Brian Ham, Chief, Auctions Division
Jonathan V. Cohen, Auctions Division (on detail)
Matthew Moses, Auctions Division
Josh Roland, Auctions Division
Walter D. Strack, Policy Division, Wireless Telecommunications Bureau
Evan R. Kwerel, Office of Plans and Policy
John R. Williams, Office of Plans and Policy
Bruce A. Franca, Office of Engineering and Technology
Tom Mooring, Office of Engineering and Technology

Steve Sharkey, International Bureau
Ronald Repasi, International Bureau
Kimberly M. Baum, International Bureau
William E. Kennard, General Counsel
Peter A. Tenhula, Office of General Counsel
Lisa M. Higginbotham, Office of General Counsel
Catherine Sandoval, Director, Office of Communications Business Opportunities
Eric Jensen, Deputy Director, Office of Communications Business Opportunities
S. Jenell Trigg, Office of Communications Business Opportunities
Jackie Chorney, Office of the Chairman
Julius Genachowski, Office of the Chairman
Rudolfo M. Baca, Office of Commissioner Quello
David R. Siddall, Office of Commissioner Ness
Suzanne Toller, Office of Commissioner Chong
David W. Zesiger, Office of Advocacy, U.S. Small Business Administration

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ATTACHMENT 1

Comment on Notice of Ex Parte Discussions
Ronald M. Harstad, Ph.D.
GN Docket No. 96-228
February 10, 1997

A memorandum to the docket, dated January 24, 1997, filed by Matthew Moses, Auctions Division, reports Ex Parte discussions held on January 23, 1997: "Representatives of wireless service providers and various segments of the investment community met with Commission staff..."

The last sentence of the memorandum says "The financial representatives also expressed general support for affording WCS licensees flexibility in how they use the WCS spectrum." This supports remarks filed in my original report. It bears emphasis that affording flexibility in spectrum usage would be inconsistent with adopting interference standards so tilted towards SDARS providers as to prevent the usage of WCS spectrum for any mobile purposes whatsoever. Interference standards that prevent mobile PACS technology applications will also prevent usage of any higher-power mobile technology.

The memorandum's principal purpose, apparently, is to inform that "representatives of the investment community expressed concern regarding whether the WCS auction, among other auctions planned by the Commission, could result in an oversupply of spectrum that would cause uncertainty in the financial markets regarding spectrum-based services." My primary purpose in commenting on this memorandum is to point out that the discussion being summarized apparently assumed that WCS spectrum would be used to support entry into the CMRS market.

True, there is reason for concern that CMRS providers may already have more spectrum than that market can support as a scarce resource. But this is *not* true of broader purposes for spectrum. In particular, WCS licensees who then create wireless competition in local exchange markets will be making a new use of the spectrum. In so doing, they will offer the first independent (as opposed to reseller) competition against the principal source of inefficiency in telecommunications markets, monopolistic local exchange carriers. It is of primary importance that the Commission announce WCS rules which, in terms of interference standards, preparation time, and bidding credits, give this possibility a chance.

ATTACHMENT 2

Comment on: Relevance to **WCS Auction** of the Submission of the Consumer Electronics Manufacturers Association

Their Submission to: IB Docket No. 95-91; GEN Docket No. 90-357

Ronald M. Harstad, Ph.D.

This Comment for GN Docket No. 96-228

February 11, 1997

Re: WCS Auction

Their Submission: Notice of Ex Parte Presentation Regarding the Establishment of Rules and Policies for Digital Audio Radio Satellite Services, submitted January 30, 1997, by William B. Wilhelm, Jr., Counsel for the Consumer Electronics Manufacturers Association ("CEMA").

Their submission presents the *Report of the Field Test Task Group; Field Test Data Collection and Presentation*, and the *CEMA Vision for Digital Audio Radio* (DAR) *Services*. CEMA was given the task of providing technical expertise for evaluating DAR technologies. Their *Report* and *Vision* are highly relevant to the issue of **Interference Rules** for the **WCS** auction.

CEMA comes to the conclusion that "the FCC should not auction DAR licenses at S-band." Extensive testing by CEMA, in conjunction with NASA, showed that "the innate propagation characteristics of S-band prove unacceptable for the provision of commercially viable DAR service." Among their key findings:

"*S-band operations suffer from a significant and startling level of signal blockage* by buildings and foliage. In major urban areas, S-band system failure rate exceeded 90%. Overall system performance is unsuitable for commercial applications;

"*Signal reacquisition times in excess of 1 second likely exceed a maximum threshold of consumer acceptance.* The S-band VOA/JPL system universally failed to satisfy this criteria;

"The propagation characteristic of *S-band frequencies will require* hundreds, *perhaps thousands, of 'gap-filling' transmitters* for a single metropolitan market, as well as other costly remedial solutions in order to achieve seamless coverage;

"As a practical matter, S-band DAR systems provide *unacceptable service quality*, and as such have no likelihood for nationwide service acceptance. Similar conclusions were reached by the independent panel investigating the satellite DAR applicants' pioneer preference applications." [Italics in original.]

The Commission is planning to reserve 25 MHz of S-band spectrum, 2320-2345 MHz, for satellite DAR services. Unless the CEMA report can be conclusively refuted, the Commission's duty is to **put these plans on hold**; contrary to Section 309.j mandates to promote the efficient use of spectrum, these plans would **prevent all** technologically feasible, let alone **efficient, usages** of this block of spectrum.

A proposal currently before the Commission threatens to greatly increase needless blockades to efficient spectrum use. To wit, the proposal is to establish interference regulations for the **WCS** auction (2305-2320 and 2345-2360 MHz) that would restrict WCS spectrum to fixed-location transmissions. The purported purpose is to prevent theoretical interference by WCS transmissions with satellite DAR broadcasts. In fact, the proposed technical specifications are so far from honest potential for practical interference that they would be farcical, were the damage they threaten not so serious. Filings submitted by DigiVox Corp., by BellCore, and by the PACS Providers Forum and other members, make it clear that **no mobile** radio technology, not even one as low-power as PACS, could use WCS spectrum if the absurd interference standards being pushed by misguided advocates at Primosphere Corp. are adopted. (Indeed, the CEMA findings show that not even Primosphere could benefit from these proposed restrictions.)

The Congressional mandate to **promote efficient use** of spectrum would be turned on its head by these interference standards: [i] the standards would **prevent** usage of the WCS spectrum by the very technologies with the **greatest potential for efficient usage**, and [ii] their proponents stubbornly seek to **protect** the adjacent spectrum (that intended to be reserved for satellite DAR services) and **reserve** it for an **infeasible** and thus **thoroughly inefficient** usage.

It seems only logical to reverse the decision to set aside 2320-2345 MHz for satellite DAR services. But this need not be decided in haste; DAR applicants should be given an opportunity to attempt to refute the CEMA findings. But a desire to find a suitable avenue for offering satellite DAR services should not be turned into a hasty and ill-conceived politicization of the setting of interference regulations for the WCS auction. Nor should this sad distraction further delay the release of rules for WCS in a form sufficiently flexible to encourage diversity in spectrum usage, by giving new mobile technologies a chance to compete.

ATTACHMENT 3

HUGHES
NETWORK SYSTEMS
A HUGHES ELECTRONICS COMPANY

February 5, 1997

John Prawat
President and CEO
DigiVox Corporation
P.O. box 65094
Washington, DC 20035

Dear John:

The January 30, 1997 Primosphere letter to the commission claims that the Hughes Network Systems (HNS) letters of January 22 and January 27 were "severely flawed and containing numerous glaring errors." HNS disagrees with this statement. This letter addresses each point made by Primosphere.

Primosphere repeats their earlier argument that 0.2 dB is a more reasonable choice of noise floor rise due to interference than 2 dB because there may be multiple interferers. HNS asserts that it is reasonable to ignore the unlikely case of a Primosphere receiver being very close to a handset from two different WCS providers at the same time, or near two base stations from two different providers at the same time. If the interferers are farther away, then their interference contribution will decrease dramatically and can be ignored. Furthermore, HNS repeats its request that Primosphere disclose their budget for margin for such effects as tree and building shadowing, Ricean fading, and terrestrial interference so that we can fairly assess the relative impact of WCS.

The next point of contention in the Primosphere letter is that "Digivox fails to recognize that the out of band emissions interference limits it recommends does not include a recommendation as to roll-off with frequency." We did not fail to recognize the need for this information, we excluded it because it is completely irrelevant. Since we have stated the amount of energy that will be found in the SDARS band, it should be of no concern to SDARS what the energy is in the intervening band. It will certainly be less than any service provided in that band and SDARS will need to design their receive filters based on such services, not on the WCS interference.

The next point is the Primosphere assertion that a "312 microsecond long burst every 2.5 milliseconds will break a communication link just as well as a continuous signal" may or may not be correct. If, for example, the symbol time is 2.5 milliseconds, then HNS' claim that the 312 microsecond interference burst will be averaged over the symbol is correct. Alternatively, if the system uses error correcting coding, the effects of individual symbol errors may not be that significant. For example a Golay (24,12) error correcting code can correct 3 errors in 24 bits which is the 1/8 error rate that would be introduced by the worst case WCS interferer. Such rate ½ codes are quite normal in the satellite channel. If

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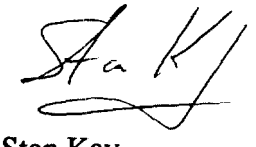
Primosphere will disclose some additional information about their modulation, coding and link margins then a reasonable assessment of the impact of the duty cycle of the WCS interferer could be made. This was explained in our January 27 letter.

Regarding the energy absorbed by the human head, we stated in our letter that the effect would be 3-15 dB depending on the orientation. It is reasonable to include some amount of absorption for the average case.

Finally, the antenna isolation of 20 dB is called into question. For an antenna mounted at 25' and a distance of 24' to the SDARS receiver, it should be clear that the SDARS is almost directly below the WCS transmitter. For example, the transmitter might be on a support cable wire holding a traffic signal where the SDARS vehicle is waiting for the light to change. The DB910C-M antenna from Decibel Products has a vertical beam pattern which is between 20 and 25 dB down in the direction of this vehicle. As the vehicle gets closer to the antenna the gain falls off dramatically. Therefore, it is not "inconceivable that such a level of isolation could be provided given the broad beam characteristics of an omni-dipole antenna" as asserted by Primosphere.

HNS wishes to repeat its request that Primosphere provide adequate information on their design assumptions so that an analysis of the effects of WCS emissions can be made relative to the other impairments they will surely suffer.

Sincerely,



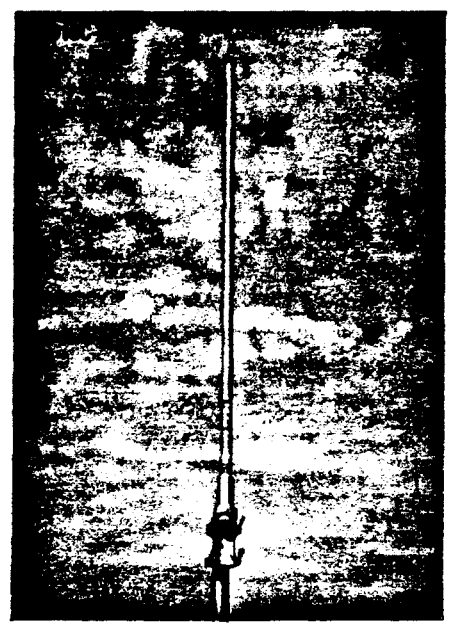
Stan Kay
Assistant Vice President
Hughes Network Systems

ASPP2933, ASPP2936 PCS OMNI ANTENNAS
DB910C-M 3, 6 or 10 dBd, 1850-1990 MHz

Decibel Products and Antenna Specialists, divisions of ATG, have created a complete line of PCS antennas for 1850-1990 MHz. With aesthetically pleasing designs and very low profiles, the field-tested antennas are now available for domestic and international applications.

Three omnidirectional transmit and/or receive models are offered with 3, 6 or 10 dBd gain.

- **Sturdy Construction** - All three have radomes of tough fiberglass, two ASP models are white in color, the DB model has blue green Mirage™ fiberglass. Radiators are made of passivated aluminum or brass, hardware of galvanized or stainless steel.
- **Power Rating** - 400 watts maximum input.
- **Trouble Free** - Each antenna is tested for power rating compliance and the absence of intermodulation generators.
- **Lightning Resistant** - Direct ground.
- **Mounting** - The ASP models are shipped with two ASPA320 mounting clamps. The DB model has an integral dual purpose mount that can be top or side mounted to a pipe with V-bolts, included.



PCS/DCS 1800 Antennas

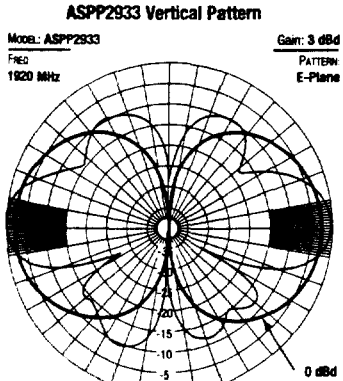
Ordering Information		
N-Female	7/16 DIN Connector	Gain – dBd/dBi
ASPP2933	ASPP2933G (on 300 mm pigtail)	3/5.1
ASPP2936	ASPP2936G (on 300 mm pigtail)	6/8.1
DB910C-M	DB910CE-M	10/12.1

Electrical Data			
	ASPP2933	ASPP2936	DB910C-M
Frequency ranges – MHz	1850-1990	1850-1990	1850-1990
Gain – dBd/dBi	3/5.1	6/8.1	10/12.1
VSWR	< 1.5:1	< 1.5:1	< 1.5:1
Beamwidth (3 dB from maximum)	32°	12°	5°
Polarization	Vertical	Vertical	Vertical
Maximum power input – watts	400	400	400
Input impedance – ohms	50	50	50
Lightning protection	Direct ground	Direct ground	Direct ground
Termination – standard	N-Female	N-Female	N-Female
Jumper cable	Order separately	Order separately	Order separately

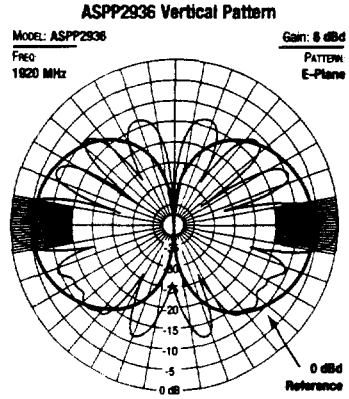
Mechanical Data			
	ASPP2933	ASPP2936	DB910C-M
Overall length – in. (mm)	24 (610)	36 (915)	77 (1956)
Radome OD – in. (mm)	1.0 (25.4)	1.0 (25.4)	1.5 (38)
Wind area – ft² (m²)	.11 (.01)	.17 (.015)	.5 (.05)
Wind load at 100 mph (160 kph) – lbf (N) kp	4.4 (19.6) 2	6.8 (30.2) 3	20 (89) 8.9
Maximum wind speed – mph (kph)	165 (266)	165 (266)	125 (200)
Weight – lbs. (kg)	4 (1.8)	6 (2.7)	5.2 (2.4)
Shipping weight – lbs. (kg)	11 (4.9)	13 (5.9)	9 (4.1)
Clamps	ASPA320	ASPA320	Integral Dual Purpose

UPS SHIPPABLE

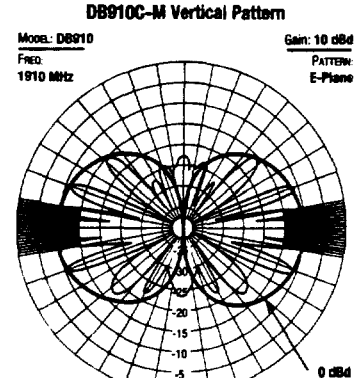
ASPP2933 Vertical Pattern



ASPP2936 Vertical Pattern



DB910C-M Vertical Pattern



ATTACHMENT 4

SWIDLER & BERLIN
CHARTERED

WILLIAM B. WILHELM, JR.
ATTORNEY-AT-LAW

DIRECT DIAL
(202)424-7827

EX PARTE OR LATE FILED

January 30, 1997

JAN 30 1997

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

VIA COURIER

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20554

Re: Notice of *Ex Parte* Presentation Regarding The Establishment of Rules and Policies for Digital Audio Radio Satellite Services, IB Docket No. 95-91; GEN Docket 90-357

Dear Mr. Caton:

Pursuant to Section 1.1206 of the Commission's Rules, 47 C.F.R. § 1.1206 (1996), on behalf of the Consumer Electronics Manufacturers Association ("CEMA"), an original and two copies of this letter are provided to advise the Commission that on January 30, 1997, in connection with the above captioned proceeding regarding proposed rules governing Digital Audio Radio ("DAR") Satellite Services, CEMA has hand delivered to the Commissioners and their staff, as well as certain other individuals within the Commission, copies of the attached Report concerning CEMA's field test results on DAR systems.

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WASHINGTON, D.C. 20007-5116
(202)424-7500 ■ TELEX 701131 ■ FACSIMILE (202)424-7645

Should you have any questions concerning this notice, please do not hesitate to contact the undersigned.

Very truly yours,

William B. Wilhelm, Jr.

Counsel for the Consumer Electronics Manufacturers Association

Enclosure

cc: Robert Greenberg (FCC)
Thomas Stanley (FCC)
Michelle Farquhar (FCC)
Johnathan D. Levy (FCC)
John R. Williams (FCC)
Robert Pepper (FCC)
Robert Briskman (Satellite CD Radio)
Howard Liberman (Primosphere)
Guy Christiansen (Primosphere)
Doug Minster (Digital Satellite Broadcast Corp.)
Diane Hinson (Digital Satellite Broadcast Corp.)
Lon Levin (AMRC)

THE CONSUMER ELECTRONICS MANUFACTURERS ASSOCIATION
VISION FOR DIGITAL AUDIO RADIO SERVICES

BACKGROUND: After almost 10 years of review, the Federal Communications Commission has endorsed the introduction of digital audio radio ("DAR") service so that American consumers can enjoy seamless, nationwide, CD quality sound over the radio.

The FCC is currently considering the best technology for making DAR available in the United States. **CEMA has been tasked with the responsibility of providing technical expertise for evaluating DAR technologies.**

DAR will provide listeners, not only the fidelity that they have come to expect from CDs, but also with real-time ancillary data services including: weather, news, traffic, emergency and other advanced services that are not available through the use of current analog broadcasting technology. In the face of declining listenership, DAR will provide a powerful opportunity to compete with other advanced digital transmission technologies available to cable providers, Internet providers, and now, television broadcasters.

THE FCC SHOULD NOT AUCTION DAR LICENSES AT S-BAND

CEMA'S VIEW: **DAR cannot be successfully provided at S-Band or on existing frequencies using IBOC/IBAC methods. The Commission must immediately reconsider its proposal to use S-Band spectrum for purposes of providing DAR within the US.**

CEMA'S TESTS: CEMA, in conjunction with NASA, has performed extensive technical testing of multiple transmission technologies, including S-Band, L-Band, IBOC and IBAC over the course of the past few years. ***CEMA's goal was to conduct an open and impartial evaluation of these technologies*** and choose the system that will satisfy realistic performance requirements in order to ensure broad consumer acceptance and the rapid growth of DAR within the US. ***CEMA and others have continually urged the Commission to not preclude any options, including spectrum options, until the technical facts on DAR system performance were established by this testing initiative.***

S-BAND DEFICIENCIES: The FCC has allocated S-Band DAR frequencies. CEMA and FCC panel testing show, however, that the innate propagation characteristics of S-Band prove unacceptable for the provision of commercially viable DAR service. CEMA's extensive battery of testing reveals that:

- ***S-Band operations suffer from a significant and startling level of signal blockage*** by buildings and foliage. In major urban areas, S-Band system failure rate exceeded 90%. Overall system performance is unsuitable for commercial applications;

- ***Signal reacquisition times in excess of 1 second likely exceed a maximum threshold of consumer acceptance.*** The S-Band VOA/JPL system universally failed to satisfy this criteria;

- The propagation characteristic of ***S-Band frequencies will require*** hundreds, ***perhaps thousands, of "gap filling" transmitters*** for a single metropolitan market, as well as other costly remedial solutions in order to achieve seamless coverage;

- As a practical matter, S-Band DAR systems provide ***unacceptable service quality***, and as such have no likelihood for nationwide commercial acceptance. Similar conclusions were reached by the independent panel investigating the satellite DAR applicants' pioneer preference applications.

CONCURRENCE WITH PIONEER'S PREFERENCE REPORT: CEMA's findings concerning use of the S-Band are consistent with the FCC's own DAR Pioneer Preference Panel findings that the proposed DAR S-Band services would require substantial terrestrial buildout in order to be viable as a seamless service.

ADDITIONAL CEMA TEST FINDINGS

IBOC / IBAC DEFICIENCIES

- ***IBOC systems failed to meet fundamental performance criteria***, including: audio quality, non-interference, and digital coverage. Accordingly, CEMA found IBOC to be categorically unacceptable.

- ***Implementing the IBAC system tested by CEMA relies on spectrum vacancies that are not available.*** Further, coverage is limited by interference from existing stations and therefore has limited potential to be successfully implemented and cannot be recommended.

* * * *

CONCLUSION: **CEMA recommends immediate FCC consideration of other spectrum options such as L-Band *(1452-1492 MHz)*, UHF or VHF.**

THE FCC MUST LOCATE OTHER, MORE APPROPRIATE DAR SPECTRUM

Because CEMA's testing conclusively finds that S-Band is unsuitable for purposes of DAR. CEMA urges the FCC to consider use of alternative spectrum, including L-Band, UHF and VHF.

FACTORS FOR CONSIDERATION: In evaluating alternative spectrum allocations, the FCC should consider reallocation of spectrum that will provide DAR with:

- ***Superior audio quality***.;
- ***Immunity to interference;***
- ***Robust transmission and recovery characteristics***;
- Significant potential for ***ancillary data capacity*** and services;
- Substantial likelihood of meeting and ***exceeding customer expectations for DAR***.
- ***Compatibility*** with other worldwide DAR systems.

180493 1

REPORT OF THE FIELD TEST TASK GROUP; FIELD TEST DATA PRESENTATION

December, 1996

Working Group B "Testing" of the CEMA - DAR Subcommittee

Prepared by
Lohnes and Culver Washington, D.C.
Robert D Culver, P.E.

REPORT OF THE FIELD TEST TASK GROUP; FIELD TEST DATA COLLECTION AND PRESENTATION

Robert D. Culver, Lohnes and Culver, Co-Chairman
Bert Goldman, Shamrock Broadcasting, Co-Chairman
EIA-DAR Field Test Task Group
December, 1996

FIELD TEST TASK GROUP, MEMBERS AND PARTICIPANTS

Robert D. Culver, P.E., Lohnes and Culver, Co-Chairman
Bert Goldman, Shamrock Broadcasting, Co-Chairman

Bud Aiello, National Public Radio
Jeffrey Andrew/Alan Parnau, USADR - CBS Radio
Talmage Ball, Bonniville International
John Bingham, Amati Communication Corp.
Randall Brunts, Delco Electronics
Ed Chen/Carl-Erik Sundberg/Nickil Jayant, AT&T Bell Laboratories
Michael Chrysochoos/Richard Zerod, Ford Motor Company
L. Claudy/J. Marino/D. Layer/D. Wilson, NAB Washington, D.C.
Aimon Clegg, CCI/Denon
Robert Finger, Matsushita Elect. Corp. of America
Ann Gallagher/Dr. H. Donald Messer, VOA
Ralph Justus, EIA-CEG DAR Subcommittee
Tom Keller, EIA-DAR WG-B, Lab Test Manager
Andrew Laird, Heritage Media Corporation
Dave Londa, EIA-DAR test laboratory manager
Anthony Masiello, USADR - CBS Radio
Charles Morgan, Susquehanna Radio Corp.
Clint Pinkham, EU-147 - Thomson Consumer Electronics
Robert Reymond, Nationwide Communications, Inc.
Dave Ritchie, SEIKO Telecommunications Systems, Inc.
William Ruck, KFOG/KNBR
Stanley Salek, Hammett and Eddison
Brian Sawyer, DRRI - CBC Engineering
Milford Smith, Greater Media
Bernee Strom, USA Digital Radio
Arv Vaisnys, Jet Propulsion Laboratories
A. J. Vigil, USADR
Ed Williams, PBS, Alexandria, Virginia

The EIA-DAR Subcommittee acknowledges the valuable support and contributions of the above Task Group members and additional support of Companies who participated in this project, specifically; AT&T Lucent Technologies, BEST Power Products, Bird Electric, Brown Broadcasting, Cablewave, CBS, Chancellor Broadcasting, Delco Electronics, Denon America, Dielectric, ERI, Family Stations, Ford Motor Company, Harris, Philip Kane, Lexicon, NASA-Ames Research Center, NASA-Lewis Research Center, NPR - Bud Aiello, Shamrock Broadcasting, Shively Labs, Thomsen Consumer Electronics, Susquehanna Broadcasting - Bill Ruck, US-NPS - Presidio, and a host of others.

Prepared by
Lohnes and Culver Washington, D.C.
December, 1996

REPORT OF THE FIELD TEST TASK GROUP; FIELD TEST DATA COLLECTION AND PRESENTATION

CONTENTS

TEST ROUTE DATA

APPENDICES

ADDENDA AND ERRATA PAGES;
REPORT OF THE FIELD TEST TASK GROUP
underline indicates changed item

INDEX PAGE, Contents page numbers; revised page attached

TEST ROUTE DATA, NOTE AND COMMENTS; new page attached

TEST ROUTE DATA, PATH OBSERVATION SUMMARIES; corrected below

Route "D";				
EU-147	64,070	63,759(99.5)	97(0.2)	214(0.3)
SEU-147	70,054	69,751(99.6)	164(0.2)	139(0.2)
AT&T	68,777	63,704(92.6)	779(1.1)	4294(6.2)
Route "P";				
no changes				
Route "N:;				
EU-147	87,997	67,250(76.4)	3,972(4.5)	16,775(19.1)
AT&T	85,669	55,859(65.2)	383(0.4)	29,427(34.4)
Route "E";				
EU-147	97,932	66,711(68.1)	2,717(2.8)	28,504(29.1)
SEU-147	76,822	36,433(47.4)	1,140(1.5)	39,249(51.1)
AT&T	88,991	49,333(55.4)	605(0.7)	39,053(43.9)
Route "S";				
AT&T	71,795	19,726(27.5)	4,894(6.8)	47,175(65.7)
Route "W";				
AT&T	76,968	28,701(37.3)	779(1.0)	47,458(61.7)
VOA-JPL	71,416	59,492(83.3)	1262(1.8)	10,662(14.9)

APPENDIX F-4, TRANSMISSION SITE LOGS, new page attached

REPORT OF THE FIELD TEST TASK GROUP; FIELD TEST DATA PRESENTATION

INTRODUCTION

This report was prepared for the Electronic Industries Association - Consumer Electronics Manufacturers Association (EIA-CEMA) DAR Subcommittee and presents the DAR Field Test Data. This report has been formatted in the anticipated form of the final report and most sections are complete. However, some sections will be revised and augmented as required with future versions of this report. Various Appendices are attached after the presented data. Most appendices are complete, however several larger or previously supplied items are represented only by cover pages with the full appendix available on request.

The purpose of this report is to present the field test data in a form sufficient for review and analysis for preparation of positions relating to the DAR systems. Questions and comments relating to the data content and the methods of collection and reporting should be referred to the EIA-DAR subcommittee. This data is "reported" directly from the measured data of the field test program without further comment or analysis. Some data, such as the vehicle velocity, have been "calculated" from the measured data, from the distance and time information, and presented as an adjunct and demonstration of other useful data which may be extracted in future revisions. No "analysis" or "results of performance" of the systems under test is made within this report. Any items which may be considered to be analytical are presented only to illustrate the type, method and sufficiency of the data collected and reported

The author of this report is Robert Culver, a partner at the engineering firm of Lohnes and Culver. He was retained by CEMA as the Field Test Design Engineer and charged with preparation of a field test Plan Participants in the interpretation of the plan to build the field test hardware and software included him, Tom Keller, Dave Londa and Robert McCutcheon from the EIA-DAR test laboratory and Michael Grimes of Lohnes and Culver. Stanley Salek and Daniel Mansergh, both of the engineering firm of Hammett and Edison were responsible for assembling the field test transmission systems and conducting the actual test measurements.

PROPONENT SYSTEM TESTING

The early CEMA-DAR testing plans called for both laboratory and field testing to be conducted on all the proponent systems submitted for testing. As many as four proponents with nine systems or variations were to be submitted for field testing and the plan (and test vehicle) was to accommodate them all. The DAB Subcommittee - Field Test Task Group, adopted a statement of "Objectives and Goals" for field testing which were incorporated into the early drafts of the test plan in 1995. The final plan was adopted by both the NRSC DAB Subcommittee and the CEMA DAR Subcommittee in June, 1995. A copy of the adopted plan (final version 5.0 dated May 30, 1995), with its attachments, is included with this report as Appendix A. Three proponents with four systems or variations were submitted and tested in the field.

FIELD TEST PLAN

The plan describes test transmission facilities to be implemented in the San Francisco area with mobile testing to be conducted in the surrounding area. The major portion of testing was conducted over long mobile paths. Those paths were chosen in advance and included areas representative of various propagation conditions. The final routes are presented in this report attached as Appendix B. Other tests were anticipated in the plan, such as short paths and measurements inside building. However, such tests were conducted only as time and events allowed as described later in this report.

ROUTES AND DISTANCE REFERENCES

Each of the six long routes were defined by starting and ending landmarks and intermediate landmarks along each route. The routes contained from 14 to 22 landmarks with the distance between sequential landmarks from several hundred meters to several kilometers. The landmarks were assigned by the field test crew at the beginning of the test process during a "pre-scripting" process to lay out the precise path along each route. Minor modifications of the actual path along portions of some of the routes were necessary because of traffic and driving restrictions. The resulting landmarks, which define the final routes and paths, were coded into the computer system used for testing. They were extracted from the computer files when all testing was completed and are presented on the cover pages for the collected data graphs.

The same landmarks were used for each proponent along each route. They are intended to form a uniform basis for comparison to determine position along a route. Linear position between landmarks was precisely determined by the use of a shaft encoder attached to the drive wheels of the test van. The shaft encoder delivered 200 pulses, or distance "Tic Marks" for each revolution of the vehicle wheels. The precise distance traveled by the van for a given number of wheel revolutions was measured and the shaft encoder distance constant was established as listed in the table below;

DISTANCE	TIC MARKS
1.171 CM	1.0
0.461 IN	1.0
1 METER	85.4
1 FOOT	26.0
1 KILOMETER	85.394
1 MILE	137.430

The short distance tic marks were used to trigger the repetitive collection of data, to precisely mark distance along a path and, together with other data (time) to calculate additional data (velocity).

DATA COLLECTED - COMPUTER DATA

The data to be collected is outlined in the test plan in Appendix A. The data presented in this report is as follows:

R.F. SIGNAL LEVEL - The R.F. signal voltage was measured at a convenient location in the mobile test bed. The method and location of R.F. voltage measurement is generally indicated in the overall field test system Block Diagram attached to this report as Appendix C. That overall Block Diagram also shows the Audio, Computer and ancillary items in the test bed. Also included in Appendix C is a detailed Block Diagram of the final configuration of the R.F. sub-section of the test bed components. Included with that Block Diagram is a tabulation of the gain and loss for each of the components in the test bed. The R.F. voltage was measured and recorded at each tic mark supplied by the shaft encoder, at each 1.171 cm (0.461 inch) of distance traveled. This R.F. data was collected at the shortest possible sample distance as determined by the shaft encoder and the vehicle wheel circumference (and at the fastest rate depending on